

Noesis: Interlocking Thinking in Math, Reading and Writing

(Noesis: Greek origin; cognition)

Submitted by WKU to the College Readiness Workgroup

Submitters: Pam Petty, Sherry Powers and Wanda Weidemann

Project Purpose: Goals for the *Noesis* model include:

- Increase number of high school graduates college prepared in math, reading and writing (English/language arts) aligning with mandates in Senate Bill 1
- Increase teacher efficacy in using critical thinking as the bridge between the cognitive processes and brain research as they relate to mathematics, reading and writing
- Increase the number of diverse students qualifying for advanced academic opportunities in math, reading and writing

Noesis (no-ē-sis) is the Greek word for cognition, thinking. Success in advanced academic learning is dependent upon noesis and the way new information is processed. College readiness is greatly impacted by the lack of critical thinking skills that students have in place when they graduate from high school. Additionally, the “piecemeal” way that departmentalization forces content to be taught at the middle and high schools levels does not align with what research tells us about how the human brain takes in and makes sense of information. The *Noesis* model is designed to develop innovative ways to engage current educators in continuing education and professional development opportunities. Specifically, the majority of middle school and high school educators are not prepared to teach these disciplines in an integrated way that makes full use of critical and logical thinking in impactful ways that encourages young people to develop their skills to a high level ensuring college readiness. Starting at the sixth-grade level and *getting in front* of the need for remedial, developmental or even transition courses for students is the most cost effective and student-centered way to approach college readiness. It is essential that we work collaboratively at all levels within the educational communities in Kentucky to align standards across P-16 institutions, to meet those standards, and to utilize or develop appropriate assessments that inform all stakeholders that students are indeed prepared as they walk across the stage at high school graduation to be successful for the rigors of post-secondary education.

To this end, we propose the *Noesis: Interlocking Thinking in Math, Reading and Writing* model with the purpose of increasing college readiness for middle and secondary students, increasing interest and achievement in critical thinking and reasoning through a weaving together of the core strands of math, reading and writing (English/language arts) and by engaging 6th grade through 12th grade teachers in innovative professional development that positively impacts student learning and college readiness.

Project Partners: *Noesis* is designed for implementation at all middle schools, junior high schools, high schools, colleges and universities in Kentucky, in partnership with the Green River Regional Educational Cooperative (GRREC), other Educational Cooperatives and P-16 Councils. The *Noesis* project will target math, reading, and English/language arts teachers in all 6th grade through 12th grade classrooms. In meetings and focus group sessions with superintendents, curriculum coordinators, guidance counselors, and teachers within the WKU service area, the consensus is that high school is

“too late” to start to ensure that students are prepared for college in math, reading and writing. To address upcoming classes of students, the *Noesis* model is developed as an outreach initiative from each of Kentucky’s colleges and universities. This broad scope of outreach will ensure that all of Kentucky’s children have access to the power of learning math “as a second language” as it is referred to in significant research studies. Universities and colleges will have dominion over the inclusion of strategies and delivery so that they can best meet the needs of their constituency as long as the core structure and content are included with fidelity. This broad net of support for learners along with essential alignments of P-16 standards and the use of assessments that accurately measure, inform, and assure stakeholders that students are genuinely prepared will be a model that ensures college readiness and one that has the potential for national recognition.

Project Description: *Noesis* is a model that can be replicated and is designed for implementation at all middle schools, junior high schools, high schools, colleges and universities in Kentucky. The *Noesis* model will target math, reading, and English/language arts teachers in all 6th grade through 12th grade classrooms. Math and literacy post-secondary faculty at Kentucky universities will partner with educational cooperatives and P-16 Councils to provide the professional development model at the center of *Noesis*. Within this one project we can begin to address college readiness at the most impacting place: the classroom through teachers prepared to use essential critical thinking as the cornerstone of instruction. The professional development course designed for *Noesis* is aligned with all strands of the Kentucky standards for math, reading, and language arts (writing).

1. Working collaboratively to address Senate Bill 1, and within structures of the Council of Postsecondary Education, the Kentucky Board of Education, the Kentucky Department of Education, the Collaborative Center for Literacy Development, the Kentucky Center for Mathematics, the Green River Regional Educational Cooperative (GRREC) and P-16 Councils the designers of *Noesis* will work to establish a statewide professional development model that *reconnects* learning processes within math, reading and writing to align with brain research and learning theory.
2. Teacher leaders recommended by administrators or who self-select to participate in the *Noesis* project will be provided with opportunities to work in cohorts within their Professional Learning Communities (PLC) to develop skills and strategies necessary to enable them to be more successful in teaching math while incorporating and complimenting research-based cognitive processes essential to reading and writing.
3. Teachers in mixed-discipline cohorts will enroll in a graduate level course that spans one year (June – May). This structure is patterned after the successful Kentucky Reading Project and Kentucky Adult Educators Literacy Institute models and allows for learning over an extended period of time, a broad scope of topics, connections between practice and theory, decision-making, and problem-solving that is job-embedded. Multiple venues for delivery will be available including face-to-face sessions and both synchronous and asynchronous electronic sessions. Teachers will participate in professional development that allows them to conceptualize the “second language” nature of math as a system that consists of abstract terms and symbols which allow them to use reading methods to help students interpret and understand mathematics as a “thinking” discipline. Content instruction will include connecting literacy, math, and critical thinking in: a) making inferences and predictions; b) analyzing;

c) determining cause and effect; d) crafting questions and answers; e) comparing and contrasting; f) symbolic reasoning, and f) using description and sequence to understand written problems.

4. *Noesis* includes a component whereby colleges and universities partner with high schools within their geographic regions to offer paired, dual-credit courses for students. Students between their junior and senior years in high school, during their senior year and between their high school graduation and beginning of their freshmen year in college would be eligible to enroll in two 3-hour courses. One course would be a college math courses at the 100 level which would be paired with a second course entitled, “Critical Thinking and Reasoning in Math and Literacy”. The focus of the critical thinking course will be to support students’ learning in the math course using the reading and writing processes along with reasoning, and logic-thinking strategies. Teachers from the *Noesis* professional development course will be recruited to partner with university faculty within the mathematics and literacy disciplines to teach these courses.

5. Community-based learning is a final component of this project. Many students struggle with math homework because there are no adults in the household who have math competencies at levels that allow them to assist their children. Middle and high school math classes for parents that allow them to learn the same content at the same pace as their children, as well as learn how to implement effective pedagogical practices with adolescent learners, is recommended as a way to include parents in schools, show parental support for mathematics, and to provide much needed math instruction to facilitate economic growth in new jobs and better jobs. These math sessions will be scheduled during the day, in the evenings, and even on Saturdays to facilitate parent and family schedules. Students and parents would have the same content and similar assignments, although the pacing will be adjusted so that parents only attend once or twice weekly. Parents who successfully complete the math course will be eligible to work as math tutors in afterschool programs.

Project Background: The U.S. is criticized in international circles for the way we segment learning and content. This segregation of learning is contrary to the way the brain works. Specifically, research indicates that a deep and functional understanding of math concepts and processes is best understood when taught through language processes, making math in essence the same as learning a “second language”. University faculty and high school teachers from a variety of disciplines recently participated in a survey as part of a research study at WKU to determine what beliefs the two groups maintain regarding college readiness. Results from the research study indicate that there is an inverted correlation between the two populations of educators regarding the issue of critical thinking. While university faculty rank it as the number one deterrent to college success, high school teachers ranked it next to last in a list of possible areas of concern. To address these discrepancies and bring the two types of institutions closer together in thinking, WKU has developed a model that includes a series of connected professional development sessions for this summer. High school teachers (50) and WKU faculty teaching psychology, sociology, political science, and history will meet for full-day professional development sessions during June and July. The sessions will focus on reading, study skills, and critical thinking strategies that enhance deep comprehension, retention, and connections with other learning. This compliments the *Noesis* model in a commitment to strengthening general education instruction ensuring that incoming freshmen are receiving the best possible pedagogy that is essential for student success.

Project Evaluation: Both quantitative and qualitative evaluations will be used to determine the success of the *Noesis*. Specifically, each goal includes an evaluation component to determine participation, effectiveness and intended outcomes. For *Noesis* to be successful, both teacher efficacy and student achievement will be measured. Additionally, goals related to diversification will be measured through involvement of diverse students in enrichment and after-school math and literacy activities. Success will come with an increase in teacher efficacy related to the teaching of math, reading and writing, as well as an increase in student achievement in the subject areas. Additionally, increased participation in math and technology programming will indicate success in both school-based and after-school programs, specifically with the participation of a diverse student population.

Project Budget and Amount of Stimulus Funds Requested:

Initiative/Goal	Funding
Statewide professional development – 6 th – 12 th grade teachers – math, reading, writing (English/language arts) – course tuition, materials, faculty incentives	\$2,500,000
Course development and related resource (electronic database)	500,000
Technology requirements (webpages, webcams for distance learning, laptops)	300,000
Training for paired, dual-credit courses; hardship funds for students unable to pay for tuition	250,000
Math classes for parents (stipends for teachers, books and materials, incentives for parents to participate and funding as tutors)	250,000
	\$3,800,000

Summary: The *Noesis* model would provide comprehensive professional development for 6th – 12th grade teachers of math, reading, writing (English/language arts) for the Commonwealth to ensure college readiness in those areas. By consistently providing cognitive connections and critical thinking within mathematics and the links between mathematical constructs and those found in the literacy process of reading and writing, students will increase skill and strategy capacity in all areas. Cognition, or noesis, is the single more prevalent missing piece to the puzzle of why so many students are underprepared to be successful at the college level. This project is a safety net to catch students before they fail.